# The Global Command and Control System: The Command and Control System for all Joint Task Forces

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In the last two years there have been some dramatic changes in command and control systems due to the rapidly changing technology and a new vision for joint command and control. The visionary concepts are defined in *C4I for the Warrior*. The Global Command and Control System is the realization of these concepts. When a JTF is formed the assets used to form the headquarters and its command and control system vary from CINC to CINC. As a result, the C4 systems provided JTF headquarters vary from operation to operation with differing capabilities. This study will answer the question of should there be a standard C4 system for a newly formed JTF headquarters. The Global Command and Control System should be the standard command and control system for all Joint Task Forces.

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# Executive Summary

Command and Control systems are an important part of joint operations. In the last two years there have been some dramatic changes in command and control systems due to the rapidly changing technology and a new vision for joint command and control. The visionary concepts are defined in *C4I for the Warrior*. These concepts are dramatically different and their implications should be understood by all warfighters. The Global Command and Control System is the realization of these concepts. Its implications must also be understood as it will affect all warfighters in the very near future if not already. The information in this study is important because of its timeliness and pertinence. This study is more than a useful compilation of information about command and control systems. It is a synthesis of this information to relate the current state of various programs in the command and control area. It provides an independent view, a reality check, and validation of the plan.

Since the decline of the Soviet Union, the planned U.S. military response has changed dramatically. This change coupled with an increased emphasis on joint operations has resulted in an increased number of crisis response and contingencies operations where the Joint Task Force (JTF) has been the primary operational organization.

When a JTF is formed the assets used to form the headquarters and its command and control system vary from CINC to CINC. As a result, the C4 systems provided JTF headquarters vary from operation to operation with differing capabilities.

As our armed forces draw down, the importance of the C4 system increases as

it becomes a force multiplier. The commander of the JTF and the JTF staff require an efficient C4 system to better coordinate the actions of the joint force in a situation characterized by its fast pace, complex battlespace, and high technology weapon systems.

This study will answer the question of should there be a standard C4 system for a newly formed JTF headquarters. The newly appointed JTF commander should know in advance that the equipment available will provide the C2 functions needed.

The Global Command and Control System (GCCS) implements the concepts of C4I for the Warrior. GCCS will provide the Warrior a global and highly interoperable C4 system. It is flexible and will satisfy the C4 requirements of any JTF regardless of size or organizational structure. The Global Command and Control System will undoubtedly be the largest and most sophisticated information management system in the world. Given its mission, it will be the most important. Where we are today is the result of a few well advised visionaries at the highest levels. They have applied the proven concepts of information technology utilization. The use of standards based, open architecture computing will prove its usefulness to the Command and Control community.

The Global Command and Control System will be the C4 system that will make the technical means of command and control transparent and seamless. The commander can concentrate on organizing the JTF in a manner to best accomplish the mission rather than organizing it to best meet C4 system constraints.

The common operating environment, the warrior friendly interface, and the

core functionality will enable joint staff officers to retain and reuse the experience gained with the Global Command and Control System regardless of which JTF, Service Component, or CINC staff they serve. The Global Command and Control System should be the standard command and control system for all Joint Task Forces.

Recommendations discussed are:

- In order to reach the Objective Phase of C4I for the Warrior, the command and control community must keep an open mind; open to new ideas as well as new technology. When problems are encountered, teamwork must be used to solve them without getting bogged down.
- Since the Global Command and Control System (GCCS) will be dependent on its distributed databases, the data element standardization efforts must receive emphasis from the highest levels. The Army and allied nations have done some good work with the C2 Core Data Model. It should be utilized to the fullest extent possible to solve this difficult problem.
- It is critical that the Migration Director for the GCCS program and the GCCS Manager be properly staffed. Just as a JTF must be staffed to accomplish its mission, the Defense Information Systems Agency and J6 need new divisions created and filled with qualified personnel to meet the GCCS implementation demands.
- Training for the Global Command and Control System must be programmed for new users as well as supporting personnel.
- There needs to be a capability to augment GCCS automation equipment. This augmentation would provide the GCCS hardware with C2 applications already installed if needed by a CINC or JTF commander.

# Glossary

I have attempted to avoid using acronyms because they tend to be more useful to the writer than the reader. However, the command and control community loves to use them. Some have become understood by even the uninitiated. I use the acronym if it has become common place and easily understood. In the other cases I spell out the complete name and follow it with the acronym in parenthesis. This is done to train the unfamiliar as well as help the expert who may not recognize the complete name. If an acronym is only used once I have not included it in this glossary.

| | |
|---|---|
| ACCS | Army Command and Control System |
| AFATDS | Advanced Field Artillery Tactical Data System |
| ATCCS | Army Tactical Command and Control System |
| C2 | Command and Control |
| C2IPS | Command and Control Information Processing System |
| C2W | Command and Control Warfare |
| C3I | Command, Control, Communications, and Intelligence |
| C4 | Command, Control, Communications, and Computers |
| C4I | Command, Control, Communications, Computers, and Intelligence |
| CIM | Corporate Information Management |
| CINC | Commander in Chief |
| CJTF | Commander, Joint Task Force |
| COTS | Commercial-off-the-shelf |
| CSSCS | Combat Service Support Command and Control System |
| CTAPS | Contingency Theater Air Control System (TACS) Automated Planning System |
| DART | Dynamic Analysis Replanning Tool |
| DCS | Defense Communications System |
| DISA | Defense Information Systems Agency |
| DISN | Defense Information Systems Network |
| DMRD | Defense Management Report Decision |
| GCCS | Global Command and Control System |
| GSORTS | GCCS Status of Resources and Training System |
| JCSE | Joint Communications Support Element |
| JDISS | Joint Defense Intelligence Support System |

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|---|---|
| JFACC | Joint Forces Air Component Commander |
| JFC | Joint Force Commander |
| JMCIS | Joint Maritime Command Information System |
| JOPES | Joint Operation, Planning, and Execution System |
| JOTS | Joint Operational Tactical System |
| JTF | Joint Task Force |
| JUDI | Joint Universal Data Interpreter |
| MTACCS | Marine Tactical Command and Control System |
| NCA | National Command Authority |
| NIPS | Naval Intelligence Processing System |
| NTCS-A | Navy Tactical Command System-Afloat |
| OSS | Operational Support System |
| SORTS | Status of Resources and Training System |
| STACCS | Standard Theater Army Command and Control System |
| TACS | Theater Air Control System |
| UCCS | US European Command (USEUCOM) Command and Control System |
| WCCS | Wing Command and Control System |
| WWMCCS | Worldwide Military Command and Control System |

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# 1. Introduction

The end of the Cold War means that the Soviet Union has ceased to be the military treat that we have lived with for forty years. Many feel that as a result the world is a safer place. While this may be the first reaction of the general public and the diplomatic naive, the truth is that the world is filled with more uncertainty than during the bipolar Cold War. In a multi-polar world, this greater uncertainty, will place a greater demand on our military by requiring response to an increasing number of possible contingencies.

The 1993 National Security Strategy reflects this change. It details the challenges politically, economically, and militarily. "Today's challenges are more complex, ambiguous and diffuse than ever before." The focus has shifted from a single global threat to one of meeting regional challenges and opportunities, from a focus on containment to one of new regional defense. The Defense program of this new strategy emphasizes the need for strategic deterrence and defense, forward presence, crisis response, and reconstitution.[1]

As a result, the National Military Strategy has changed too. Since the decline of the Soviet Union the concept of threat analysis has changed. Its definition of the new threat is very important. "The real threat we now face is the threat of the unknown, the uncertain."[2] Due to decline in the force structure, the strategic principle of technological superiority is very important and includes the areas of Command, Control, Communications, and Computers (C4) as well as weapon systems.

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[1] The White House, *National Security Strategy of the United States*, January 1993, pp. 1 & 13.

[2] Office of the Joint Chiefs of Staff, *National Military Strategy of the United States*, January 1992, p. 4.

> The United States must continue to rely heavily on technological superiority to offset quantitative advantages, to minimize risk to US forces, and to enhance the potential for swift decisive termination of conflict. In peace, technological superiority is a key element of deterrence. In war, it enhances combat effectiveness and reduces loss of personnel and equipment. . . . Therefore, advancement in and protection of technology is a national security obligation."[3]

The flexibility needed in this new environment requires a new approach to provide the Command and Control (C2) systems needed to support the new missions of forward presence, crisis response, contingency operations, and reconstitution.

Since the decline of the Soviet Union, the planned U.S. military response has changed dramatically. This change coupled with an increased emphasis on joint operations brought on by the 1986 Goldwater-Nichols Act has resulted in an increased number of crisis response and contingencies operations where the Joint Task Force (JTF) has been the primary operational organization due to the pace of the development, the need for multi-Service commitment, and the size of the military force involved. A JTF is established when the mission has a specific limited objective and the mission assigned should require execution of responsibilities involving two or more Services on a significant scale with close integration of effort.[4] The JTF has become the recognized method for dealing with contingency operations. Each Commander in Chief (CINC) of the Unified Commands, however, uses a different approach to stand up the JTF headquarters. When a JTF is formed the assets used to form the headquarters and its command, control, communication, and computer (C4) system vary from

[3] Ibid., p. 10.

[4] Office of the Joint Chiefs of Staff, Joint Pub 0-2 Unified Action Armed Forces (UNAAF), 1 December 1986, p. 3-27.

CINC to CINC. In some cases both the personnel and equipment are taken from the CINC headquarters. In other cases the assets must come from other sources. As a result, the C4 systems provided JTF headquarters vary from operation to operation with differing capabilities and degrees of interoperability with C4 systems used by Service components to the JTF. This fact has serious ramifications with respect to the time and effort needed to train a staff to effectively use the C4 system. The increased use of the JTF makes this issue even more critical.

As our armed forces draw down and the trend to joint operations continues, the importance of the C4 system increases as it becomes a force multiplier. The commander of the JTF (CJTF) and the JTF staff require an efficient C4 system to better coordinate the actions of the joint force in a situation characterized by its fast pace, complex battlespace, and high technology weapon systems. General Gordon Sullivan, the Army Chief of Staff, describes the increased reliance on C4 systems as "Third Wave Warfare" where the appropriate information technology is used to apply the scarce resources of our forces on the battlefield by simultaneous application of complementary capabilities. "Third Wave Warfare" requires us to win the information war with better information and more timely decisions resulting in, for example, situations where it only takes "three minutes from sensor to shoot."[5]

This study will answer the question of whether or not there should be a standard way to configure and implement a C4 system for a newly formed JTF headquarters. The thought of a newly appointed JTF commander finding out that the bits and pieces of computer equipment brought to his headquarters by

[5] Sullivan, Gordon, General U.S. Army, Speech to the U.S. Naval War College, Newport, RI: 14 December 1993.

the newly appointed JTF staff will provide some office automation functions, but no C2 functions is frightening. Being the new J6 and having to borrow precious C4 system resources from subordinate or higher headquarters is a frightening thought too. A better situation might be that the new JTF commander has his present staff and its C4 system. But, if the C4 system must be augmented so that it has enough capacity to perform JTF and component planning simultaneously, there may still be a problem. Knowing in advance that the equipment is available, that it will provide the C2 functions needed, that the staff will be familiar with it, and that it is interoperable with the C4 systems at the echelons above and below the new headquarters is a much more comforting thought. These are the reasons the question has been posed.

This study will also discuss other areas such as Command and Control theory, how the Unified Commands plan on establishing JTFs, the trends of C4 systems over the past few years, major directives and initiatives that have influenced the implementation of C4 systems, and the future direction for C4 systems. This information will be useful to a broad audience, from the new Joint Staff Officer, to a new CINC or JTF staff J6[6], or a staff officer wishing to learn more about the automated C4 systems.

[6] The J6 is the Director for Command, Control, Communications, and Computer Systems.

## 2. Background

Command and control is defined as the "process that commanders (including supporting organizations) use to plan, direct, coordinate, and control forces to ensure mission accomplishment." C4 systems (also referred to as C2 systems) are defined as the "supporting system(s), which include both the C2 systems and the communications and computer systems required to implement the C2 process."[7]

In his book, *Command In War*, Martin Van Creveld describes three categories to classify the means of command that can be used to describe any C4 system. These are the organizations; the procedures including doctrine, processes, and training; and the technical means which includes the automated C4 systems.[8]

### A. The Organization

The Goldwaters-Nichols Act has already had impact on the organizational issues of C2 by requiring the Service Chiefs to give up much of their advisory and strategic direction functions to the Chairman of the Joint Chiefs of Staff and the Commanders in Chief of the Unified Commands. The organizational direction since 1986 has been more and more toward "jointness". Other organizational issues that will be addressed are the methods used to create the JTF, designate the CJTF, and field its C4 system. These organizational issues are important. For example, the issue of what organization makes up the nucleus of the JTF and how this affects the C4 system makes a tremendous difference on the

[7] Office of the Joint Chiefs of Staff, *Joint Pub 6-0, Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations*, 3 June 1992, pp. I-4 & I-5.

[8] Van Creveld, Martin, *Command in War*, (Cambridge: Harvard University Press, 1985), pp. 9-10; Garretson, Jeremiah F., "Confronting Challenges to Jointness: Initiatives for Joint Command and Control," Unpublished Research paper, U.S. Naval War College, Newport, RI: 1993, p. 3.

effectiveness of the C2 process. The issue of whether it is wise for the CJTF to be wearing two hats (as CJTF and Commander of the predominate Service component) versus relinquishing his former responsibility as a component commander has been viewed as also making a difference in the C2 effectiveness. In the dual role situation, portions of the JTF staff are usually playing dual roles. The C4 system used by the JTF headquarters will most likely be playing two roles also. This organizational issue can greatly affects the technical means brought to bear on the C2 problem. Furthermore, the C4 system will be more effective if the selection of the C4 system for the JTF can be made without being affected by the dynamic issues involving the selection of the JTF commander and other organizational issues.

## B. Doctrine for Command and Control Systems

Likewise, the procedural issues of training, processes and doctrine should not be affected by the selection of the C4 system for the JTF. Doctrine attempts to define the methods that optimize the application of national military power to achieve strategic goals.

> Because we operate and fight jointly, we must all learn and practice joint doctrine, tactics, techniques, and procedures; feed back to the doctrine process the lessons learned in training, exercises, and operations; and ensure Service doctrine and procedures are consistent. Joint doctrine offers a common perspective from which to plan and operate, and fundamentally shapes the way we think about and train for war.[9]

The doctrine for C4 systems emphasizes that joint and Service C4 systems strive

[9] Office of the Joint Chiefs of Staff, *Joint Pub 1, Joint Warfare of the US Armed Forces*, 11 November 1991, p. 6.

to achieve maximum effectiveness while insuring interoperability and compatibility.[10] "Interoperability encompasses doctrine, procedures, and training--as well as systems and equipment. Simply put, interoperability is the overall ability of Warfighter [C4] systems to exchange voice, data, and imagery information effectively, in near or real-time, as dictated by the operational situation."[11] Training received, especially training related to using the C4 system, must remain pertinent regardless of the C4 system selected. Staff processes, training, and doctrine can not be C4 system dependent. The technical means of command and control must be transparent to the other functions of command.

## C. Policy for Command and Control Systems

Due to the rising cost of automation and the duplication of effort among the Services, several policy initiatives were taken over the past ten years intended to reduce the costs of automated systems and to insure greater interoperability. The problem has been clearly articulated by Lieutenant General John H. Cushman, US Army Retired, in an article entitled "Joint Command and Control". Here he states: "Deficiencies in joint C2 stem primarily from an enduring legacy of service compartmentalization." And he characterizes the results. "Current C2 systems are the heritage of years of largely unplanned splicing together of ill-fitting components that were delivered to the service elements of joint forces by relatively independent parties far away, who coordinated adequately neither

[10] Office of the Joint Chiefs of Staff, *Joint Pub 6-0, Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations,* p. II-1 .

[11] Office of the Secretary of the Army, Director of Information Systems for Command, Control, Communications, and Computers, *The Army Enterprise Strategy, THE VISION,* (Washington: 20 July 1993), p. 13.

with the joint commanders nor with each other."[12] Recent initiatives that have attempted to deal with this problem come in the form of directives and programs.

Department of Defense Directive 4630.5, "Compatibility, Interoperability, and Integration of Command, Control, Communications, and Intelligence (C3I) Systems" has directed that C4 systems "must be compatible, interoperable, and integrated, and that all C3I systems developed for use by U.S. forces are considered to be for joint use."[13]

Department of Defense Directive 4630.8, "Procedures for Compatibility, Interoperability, and Integration of Command, Control, Communications, and Intelligence (C3I) Systems", "tasks CINCs to assess new or modified C3I systems for their impact on JTF operations and to report any incompatibility or lack of effective interoperability and integration. It tasks the Director of the Defense Information Systems Agency to be the DOD single point of contact for development of technological standards for information processing and information transfer and to conduct a program to verify whether emerging C3I systems are indeed interoperable."[14]

*Defense Management Report Decision (DMRD) 918, The Defense Information Infrastructure,* established the Defense Information Systems Agency (DISA) as the organization with the responsibility to centrally manage the defense information infrastructure. The purpose is to achieve an integrated

[12] Cushman, John H., "Joint Command and Control," *Military Review,* July 1990, pp. 26 & 32.

[13] Snyder, Frank M., *COMMAND and CONTROL The Literature and Commentaries* (Washington, D.C.: National Defense University Press, 1993), p. 118. The latest version is dated 12 November 1992, but an earlier version with a slightly different title was dated 9 October 1985. The author notes the significance of the name change. The word "Integration" was added and the word "Tactical" was deleted as a modifier of C3I systems. This helps to erase the line between tactical and strategic systems.

[14] Ibid.

global information infrastructure to provide end-to-end interconnectivity in a cost effective and secure manner. Excluded from the plan are existing C4 systems, intelligence systems, tactical communications and other legacy systems. It also enlarged the Defense Information Systems Agency considerably by consolidating several functions, organizations, and assets within Defense Information Systems Agency. As a result, the Defense Information Systems Agency is now responsible for planning, developing, and supporting new C4 systems used at all levels of command from the National Command Authority (NCA) down to the tactical level, in war time and in peace, to include NATO and allied C4 systems and commercial systems that may be integrated with the Defense Communications System (DCS).[15] Security, standards, communications, computing, Central Design Activities, and acquisition are other areas for which the Defense Information Systems Agency has become the central manager. Education is another issue which has been centralized. The Assistant Secretary of Defense for C3I, will determine the most appropriate method to centralize education for the information technology. Probably the most profound impact of DMRD 918 is the consolidation of information technology funding.

The Corporate Information Management (CIM) initiative is the umbrella program for these new directions. A concern of the Corporate Information Management initiative is a business process review within several functional areas that overlay information systems. The functional areas cover a wide range from pay to personnel and include C4I. The concept is to modernize the aging DOD information systems using modern information technology practices. The amount saved will be more than the cost of modernization. What are these

[15] Office of the Joint Chiefs of Staff, *Joint Pub 6-0*, p. IV-3.

practices? Basically they are what the computer industry has been evolving toward and proving since 1985 and what Fortune 500 companies have been implementing to reduce cost and increase competitiveness. They are the use of common databases, open systems architecture and standards based systems. Common databases promote data integrity, availability, consistency, and the need to enter data only once. Open systems architecture makes system and application software modular and portable so that it can take advantage of future technological innovations and migrate easily to new higher performance hardware. Standards based systems make it easier to integrate the products from multiple vendors which enables system designers to choose the highest performance and least expensive products.

## D. The Technical Means

The Service's C4 systems have been affected by these trends. For the most part they have been developed on open systems using common standards for communications, graphics, displays, and operating systems. The result is that compatibility and interoperability among the Service systems is closer than ever before. For example, the Air Force's Contingency Theater Air Control System (TACS) Automated Planning System (CTAPS) has been successfully run on the Navy's Joint Maritime Command Information System (JMCIS) hardware. As described in the white paper entitled *Integrating CTAPS ATO Applications into the JMCIS Environment*[16] this is possible for the reasons just discussed.

[16] ATO stands for Air Tasking Order which is the order produced by the air component commander which plans air strikes in the area of operation for execution by the air component which may be a joint air component.

> Architecturally and programmatically, CTAPS and JMCIS have much in common. Both programs are based upon evolutionary acquisition and have adopted a common core software layer that is based on current open systems technology. While there are some differences in the methodology of the two cores, their open system nature makes integration of the two systems feasible. This integration has become more desirable in today's joint environment.[17]

This sets up the situation where joint C4 systems can be developed by selecting the best hardware and the best software providing the needed functionality. This "best of breed competition" makes the possibility of a standard C4 system for the JTF an easier undertaking. The fact that this is technically possible is important. However, possibly even more important is the cooperation among the Services that will allow the evolution to a common C4 system.

## E. Command and Control Warfare

A new area of concern in the C2 arena is Command and Control Warfare (C2W). The emphasis that is now being given C2W shows the importance of C2 to both friendly and enemy forces. The definition of C2W gives some insight into the dependence we envision our own forces having in their C4 systems.

> The integrated use of operations security (OPSEC), military deception, psychological operations (PSYOP), electronic warfare (EW) and physical destruction, mutually supported by intelligence, to deny information to, influence, degrade or destroy adversary C2 capabilities, while protecting friendly C2 capabilities against such action. Command and Control Warfare applies across the operational continuum and all levels of conflict.[18]

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[17] Science Applications International Corporation and Inter-National Research Institute, *Integrating CTAPS ATO Applications into the JMCIS Environment*, (Hampton, VA: 7 September 1993), p. 1.

[18] Office of the Joint Chiefs of Staff, *CJCS Memorandum of Policy No. 30, Command and Control Warfare*, 8 March 1993, p. 2.

The concept of information warfare is to be able to gather and process data in order to make good decisions faster than an adversary. This idea falls under the operational principle of agility. In order to be agile, our forces will rely on effective C4 systems. *Fleet Marine Force Manual (FMFM) 3, Command and Control,* expresses the importance of our C2 effectiveness in the following: "The measure of command and control effectiveness is simple: either our command and control works faster than the enemy's decision and execution cycle or the enemy will own our command and control."[19] By allowing our forces to react faster than the enemy our forces will be more agile. Since agility is relative, the objective is to be more agile than the enemy. Realizing the importance of our C4 systems, one way to increase our relative agility is to destroy the enemy's C4 systems. "Effective C2W enables the commander to seize the initiative by forcing the enemy into a reactive mode, while maintaining, protecting and/or enhancing the effectiveness of friendly C2."[20]

[19] USMC, *FMFM 3, Command and Control, coordinating draft #2, Edition 6,* March 1993.
[20] Office of the Joint Chiefs of Staff, *CJCS Memorandum of Policy No. 30,* p. 4.

## 3. How the Commanders in Chief form JTFs

An examination of the various methods the CINCs use to form JTFs is necessary to better understand the C2 process and problems facing C4 systems implementation. It will also show the diversity of C4 systems that can be encountered by a Joint Staff Officer assigned to a JTF. Interestingly, this topic is receiving much needed attention, is a hotly debated topic, and is viewed primarily along the organizational and process functions of command. The technical means function of command is usually reduced to communications issues with little discussion of the computer portion of C4 systems. This may be because until recently those with the responsibility for C4 systems were primarily communicators or that the problems of integrating automation support were too complex. Automators are becoming more involved as a result of the emphasis that has been place on information management and the defense information infrastructure under the Corporate Information Management initiative.

### A. U.S. European Command

European Command[21] has had a great deal of experience standing up JTFs since the mid 1980s. The 1986 air raid on Libya; evacuating non combatants from Liberia in the midst of a civil war in June 1990; launching air strikes from Turkey against Iraq during Desert Storm; sending Patriot missiles to Israel during the Gulf War; providing humanitarian relief to the Kurds in northern

[21] Common abbreviations for European Command are EUCOM and USEUCOM which will be seen in quotes that follow.

Iraq after the Gulf War; bringing humanitarian assistance to the republics of the former Soviet Union; and finally air dropping food and medical supplies into Bosnia-Herzegovina are the most recent examples. Additionally, European Command has gained additional experience in planning many other contingency operations which never took place.[22]

European Command's approach to forming the JTF, called building on a "Component Basis", is to base the JTF on the JTF's major component Service which provides the permanent structure. Formerly, this concept was termed "Core Staff" because the the core staff was the staff of the component that provided the commander for the JTF and at least 51% of the staff and most likely the complete C4 system. The disadvantages were that a single component could not afford the overhead and still function in its component role. This "robbing Peter to pay Paul" approach would leave the JTF headquarters in the unbalanced position of having to fill dual roles.

The new component basis approach requires that each participating Service support the JTF staff on an equal basis. Initially this appears to make the problem of fielding a C4 system for the staff more difficult because each Service would be bringing pieces of their own C4 system creating an integration nightmare. This problem is overcome by the use of equipment, and if necessary, personnel augmentation provided by the European Command headquarters. For C4 issues there is the Communications Planning Team lead by a colonel from European Command headquarters who becomes the JTF's Director for Command, Control, Communications, and Computers, the J6. "This does not reflect on the capability of our [European Command] component

[22] Ellertson, Colonel, "Forming the Joint Task Force, HQ USEUCOM's Approach to the Process," Lecture slides and notes, U.S. Naval War College, Newport, RI: 11 March 1993, p.2.

communication officers rather it reflects our feeling that an officer with joint experience can more quickly tap all communications capability available in EUCOM."[23] Presumably, this team would also provide the needed C4 system augmentation in the way of the CINC's developed USEUCOM Command and Control System (UCCS). This augmentation insures a common C4 system for all JTFs and produces a "JTF staff that links smoothly with HQ USEUCOM because it is almost a mirror image of it."[24]

## B. U. S. Atlantic Command

Atlantic Command[25] recognizes that JTFs are not standing organizations and that there is an ad hoc character to a newly formed JTF even if it is based on an existing component organization. The Atlantic Command operational experience with JTFs is less than European Command's with the most notable being the Grenada invasion in 1983. Several exercises have been conducted giving experience with the issues of JTFs such as Ocean Venture 93. The most recent experience has been in Haiti with the naval quarantine that has been in place for several months.

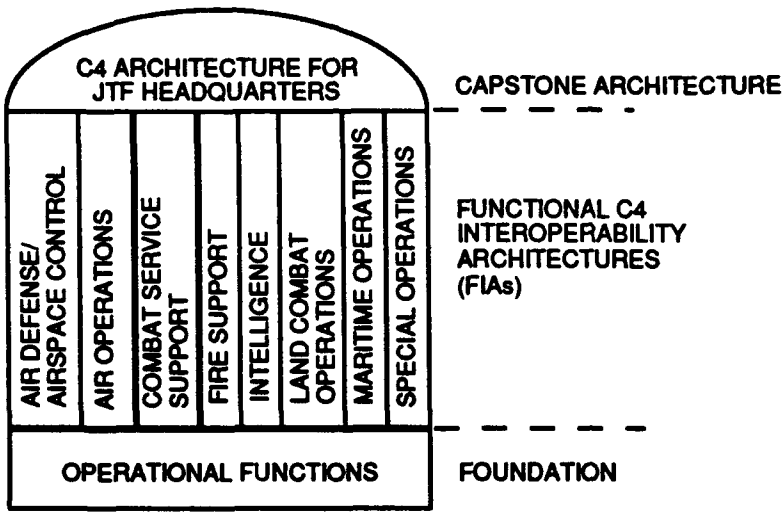
[23] Ibid., p. 9.

[24] Ibid.

[25] Common abbreviations for Atlantic Command are ACOM, USACOM, and the older USCINCLANT which was the command's name prior to 1 October 1993.

Atlantic Command has recognized the need for a C4 system at the JTF headquarters. Specifically, the need for a C4 system that spans the Functional C4 Interoperability Architectures (FIA) as shown in Figure 1.[26]

Figure 1. C4 Architecture




Source: HQ, USCINCLANT, *USCINCLANT Join Task Force (JTF) Policy, Coordinating Draft*, 18 December 1992, p. 5.

The *USCINCLANT Joint Task Force Policy* tasks the Joint Force Commander (JFC) with the C2 issues:

> In conjunction with battlefield design, the JFC must also develop his C4I requirements to support the concept of operations. As planners develop a C4 architecture for the JTF headquarters, consideration must be given to various operational requirements in order to ensure that functional C4 architectures are developed . . . Subsequently, courses of action are reviewed for communications supportability prior to their selection, rather than after the fact."[27]

[26] HQ, USCINCLANT, *USCINCLANT Join Task Force (JTF) Policy, Coordinating Draft*, 18 December 1992, p. 5.

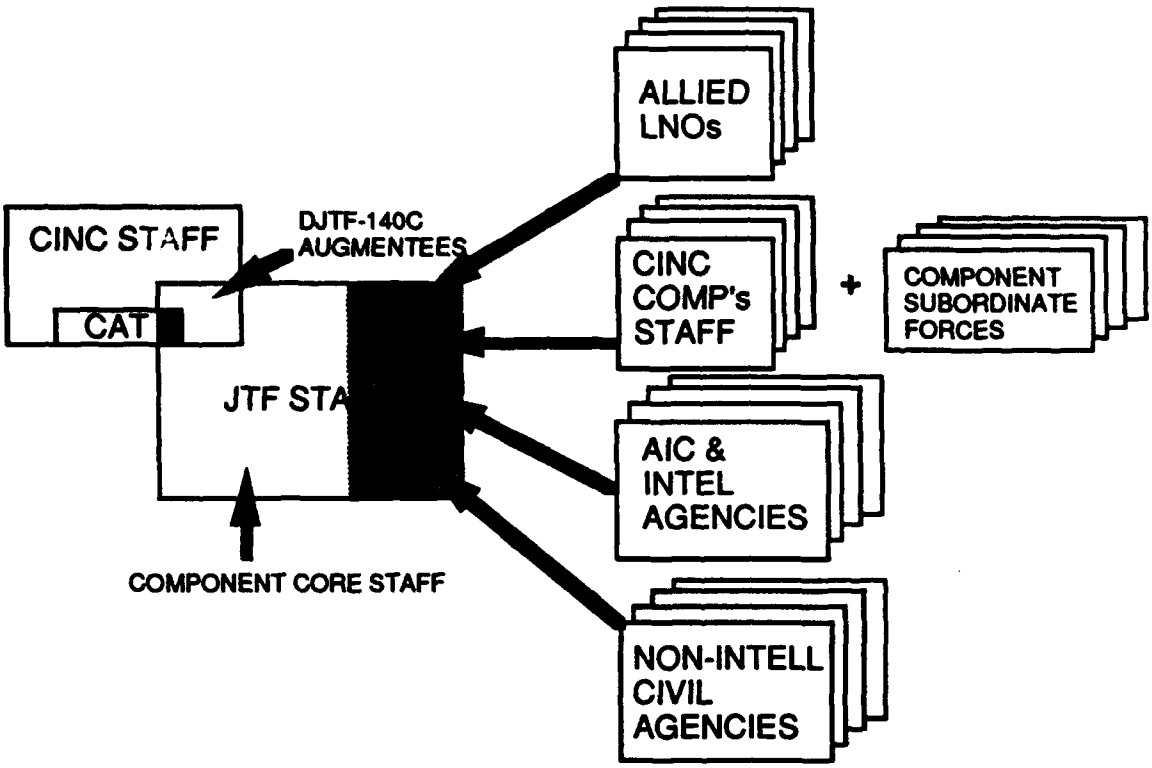
[27] Ibid., pp. 4-5.

Atlantic Command has consciously included communications as a sub element of C4I rather than addressing C4I requirements solely from a communications perspective.

The method Atlantic Command uses to create the JTF staff is the "core staff" approach where the JTF staff is provided by the lead component commander designated as the JTF commander. Atlantic Command recognizes the need for augmentation and has a deployable planning cell, the Deployable Joint Task Force 140 Cadre (DJTF-140C). This augmentation cell consists of CINC staff members as well as augmentees from the Service components. If possible, the Cadre staff will help prepare the CINC's Assessment and may also help the CINC staff prepare the Commander's Estimate. Figure 2 shows the sources of personnel for the JTF staff. It is interesting that Atlantic Command uses the C4I capability as one of the criteria to determine which component commander will be selected as the JTF commander. "Selection will normally be based on the nature of the mission. If there is general parity in Service contributions to the JTF mission, JFC selection will be based on a combination of component C4I capability, most recent exercise or real world JTF experience, and likelihood of follow-on missions where JTF transition might otherwise have to occur."[28]

[28] Ibid., p. 8.

Figure 2. Formation of JTF Staff




Source: HQ, USCINCLANT, *USCINCLANT Join Task Force (JTF) Policy, Coordinating Draft,* 18 December 1992, p. 7.

## C. U. S. Pacific Command

Pacific Command[29] has traditionally used a three echelon C2 structure when exercising subunified commanders in their major operations plan role. The three echelons are the CINC, the Subunified commander or Designated Component commander, and the warfighting commander. With the increased likelihood of having to react to smaller crisis situations, Pacific Command employs a two echelon C2 structure for dealing with contingency operations. The two echelons are the CINC and the JTF commander. Pacific Command has seriously considered how to implement the C4 system for its contingency JTF in the *US Pacific Command Contingency Operations C3I Support Plan*. Specifically Pacific Command's C3I concept of operations calls for C4 systems at component headquarters that "must be identical or have functional interoperability with those available at HQ USPACOM."[30] Furthermore, the C4 system for the JTF must be small, lightweight, highly portable, and interoperable with Pacific Command headquarters.

Pacific Command will form the JTF staff from one of the component Service headquarters. This will be augmented with a Deployable Joint Task Force Augmentation Cell (DJTFAC). The DJTFAC provides the joint planning capability not inherent to the Service headquarters. The CINC appoints a flag officer from a Service different than the JTF commander's as the Deputy CJTF.

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[29] Common abbreviations for Pacific Command are PACOM and USPACOM which will be seen in quotes that follow.

[30] Defense Information Systems Agency, *US Pacific Command Contingency Operations C3I Support Plan: Vol. I, Overview and Concept of Operations* (Washington, D.C.: June 1992), p. 22.

This gives another Service's expertise at the highest level within the JTF. The JTF candidate headquarters are 7th Fleet, III MEF, and I Corps.[31]

[31] HQ USCINCPAC, *Establishment of Contingency Joint Task Force*, USCINCPACINST 3120.26E (Camp H.M. Smith, HI: 20 January 1993).

# 4. The Services' Command and Control Systems

Each of the Services has developed its own C4 system. There are several reasons for this. First, the Services developed their C4 systems independently. Second, the Services viewed many of the functional requirements of their C4 systems as unique or gave them differing priorities than the other Services. As computers began to be used for C2 functions, the "vision" of how to best employ them were also different The difference in basic requirements is fundamentally true as the requirements for controlling ground forces are different than for controlling naval or air forces. Despite this, some of the functional requirements of the Services C4 systems may be the same. Examples are weather or intelligence functions. What follows is a description of the Service's C4 systems as they exist today.

## A. Army

The Army Command and Control System (ACCS) is divided into three levels. The Army World Wide Military Command and Control System Information System (AWIS) provides the functions for Army participation in the Joint Operation, Planning, and Execution System (JOPES) for planning and execution from mobilization and deployment through employment, sustainment and reconstitution. The Standard Theater Army Command and Control System (STACCS) supports the theater Army at levels above corps and is the link between strategic and tactical C4 systems. The Army Tactical Command and Control System (ATCCS) is the tactical C4 system.

The Army's highest operational echelon C4 system is called the Standard

Theater Army Command and Control System (STACCS). Its purpose is to serve the echelons above corps by supporting Theater Army requirements from theater headquarters to the army major commands and corps. It supports peacetime, crisis, and wartime force tracking (for forces above corps level) , rear area operations and sustainment in the theater of operation. It uses off the shelf hardware to establish a wide area network for access to common data that is available on network servers. It is designed to provide timely and accurate information concerning hostile and friendly forces both horizontally among Army command staffs and vertically. Vertically it interoperates with multi-service and multi-national C4 systems. It operates at the secret level with the Worldwide Military Command and Control System (WWMCCS). It also interfaces with the Standard Army Management Information Systems at the major command level providing access to personnel and logistics systems. This is especially important as split-based operations become more common. With split-based operations the sustaining base does not have to be in theater. This allows for power projection rather than forward presence without adding the burden to the deployment flow that would result from deploying many of the logistics functions. The Standard Theater Army Command and Control System is run on open systems[22] hardware and software and utilizes standards based communications protocols. It provides the following functions: force control, general computer applications, situation map graphics, and briefing support.

The Army Tactical Command and Control System (ATCCS) consists of systems for five Battlefield Functional Areas. These are Maneuver, Fire

[22] Open systems are hardware and software systems that support an open operating system such that programs written for one open system can be transferred to another open system without major modification.

Support, Air Defense Artillery, Intelligence/Electronic Warfare, and Combat Service Support. Figure 3 shows the functional area and their corresponding systems. It operates its distributed system over three communications systems, Mobile Subscriber Equipment (MSE), Single, Channel Ground and Airborne Radio System (SINCGARS), and the Army Data Distribution System (ADDS). These communications systems allow interoperability with other Services, NATO forces, commercial systems, combat net radios and multichannel satellite systems.[33]

Figure 3. Battlefield Functional Areas and Supporting Systems

| Battlefield Functional Area | System |
|---|---|
| Maneuver | Maneuver Control System (MCS) |
| Fire Support | Advanced Field Artillery Tactical Data System (AFATDS) |
| Air Defense Artillery | Air Defense Command and Control (ADSSC) |
| Intelligence/Electronic Warfare | All Sources Analysis System (ASAS) |
| Combat Service Support | Combat Service Support Command and Control System (CSSCS) |

Source: U.S. Army Program Executive Office, Command and Control Systems, *ACCS, Command & Control for Today's Battlefield* (Fort Monmouth), p. 1.

[33] U.S. Army Program Executive Office, Command and Control Systems, *ACCS, Command & Control for Today's Battlefield* (Fort Monmouth). This was the major source for information on Army Systems.

## B. Air Force

The Air Force's C4 program is called Theater Battle Management and consists of several core systems designed to support the Air Force commanders at the Joint Forces Air Component Commander (JFACC) level and below. They are the Contingency Theater Air Control System (TACS), Automated Planning System (CTAPS), Command and Control Information Processing System (C2IPS) and Wing Command and Control System (WCCS). The core systems provide the automation required to plan, build, disseminate, execute and track the Air Tasking Order. Theater Battle Management also includes the ability to coordinate support activities and exchange C2 information between theater, air force, and unit levels. The systems are based on commercial-off-the-shelf, open system products which are standards based and provide joint interoperability, security, and near real time capabilities.[34]

CTAPS is a project producing an architecture to automate the processes of the Air Control System. CTAPS is fielding a new modular Air Operations Center (AOC), implements the Wing Command and Control System which provides unit level automation, and will field the Air Support Operations Center (ASOC). CTAPS is built on open system standards, a distributed client-server architecture, common database data integration, and standards based communications protocols. CTAPS also provides common services such as electronic mail, message processing, and office automation applications.[35] CTAPS interfaces with airborne C2 platforms, Department of Defense networks, Navy, Army, and

[34] U.S. Air Force SCMC, *Theater Battle Management Point Paper* (Washington, D.C., 1993) p. 1.

[35] SAIC, "Contingency TACS Automated Planning System (CTAPS)," Briefing, Norfolk, VA: January 1994.

Marine C4 systems.[35] The functional components of the CTAPS architecture and their capabilities are shown in figure 4.

Figure 4. CTAPS Core Systems

| Core Systems | Description |
|---|---|
| Advanced Planning System (APS) | Air Battle Planning and ATO Production |
| Airspace Deconfliction System (ADS) | Airspace planning and Management |
| Battlefield Coordination Element (BCE) Automated Support System (BASS) | Army-tailored ATO query capability and support to the BCE for mission planning. |
| Combat Air Force Weather Software Package (CAFWSP) | Current and forecasted weather |
| Computer Assisted Force Management System (CAFMS) | ATO dissemination, execution, and monitoring |
| Improved Many on Many (IMOM) | Electronic Counter Measure (ECM) support and electronic combat analysis |
| Intelligence Correlation Module (ICM) | Intelligence, fusion, and database maintenance |
| JFACC Decision Support System (JDSS) | Situation displays, reports and data screens |
| Joint Munitions Effectiveness Manual (JMEM) | Weaponeering |
| Rapid Application of Air Power (RAAP) | Target development |
| Route Evaluation Module (REM) | Penetration route analysis |

Source: U.S. Air Force SCMC, *CTAPS Core and "Feed" Systems* (Washington, D.C., 1993) pp. 1-4; SAIC, "Contingency TACS Automated Planning System (CTAPS)," Briefing, Norfolk, VA: January 1994.

[35] U.S. Air Force SCMC, *CTAPS Core and "Feed" Systems* (Washington, D.C., 1993) pp. 3-4.

## C. Navy

The Navy C4 systems are based on the Copernicus Architecture, which was developed in 1989 to place the tactical commander at the center of information flow under a common operating environment. The purpose of Copernicus is to provide the commander control by allowing the user to pull information needed rather than having data pushed to them. It is based on four pillars: the Global Information Exchange System (GLOBIXS) to insure information exchange from non-battle group and shore-based sources, the CINC Command Complex (CCC) for consolidation of information, the Tactical Information Exchange (TADIXS) for the transfer of information from the CCC to the afloat commander, and the Tactical Flag Command Center (TFCC) which is the tactical decision support system to support the warfighting commander. The principles of Copernicus are:

- to make tactical C4I seamless with non-tactical management information systems,
- utilize user pull rather than producer pushed data flow,
- provide multimedia capability for voice, data, and video,
- use a common operating environment, and
- build the system using a common building block approach.

The result of the Copernicus architecture has been a rapid evolution of C4 systems using standards based building blocks for both hardware and software with planned migration to new technology as it becomes available. The latest is the Joint Maritime Command Information System (JMCIS), the umbrella program that includes the Navy Tactical Command System-Afloat (NTCS-A).

NTCS-A is the latest in the family tree that began with the Joint Operational Tactical System (JOTS) in the early 1980s.[37]

NTCS-A uses commercially available hardware referred to as non-developmental items (NDI), commercial-off-the-shelf (COTS) software, government owned software, and industry standards. NTCS-A provides the user with a single, integrated, and scalable management information systems. The project strives to retire obsolete systems even if some functions have not been replaced. The philosophy is to have 80% of the desired functionality now rather than waiting to have 100% functionality later. In order to provide the greatest amount of portability or the ability to move government owned software to new platforms, NTCS-A software subsystems are built on top of the Unified Build. Unified Build is a software core that provides common C2 functions for all Navy afloat and ashore C2 programs. The Navy has placed a great deal of emphasis on getting maximum user participation. NTCS-A supports C4 requirements at all levels of command, from battle group commander to the naval component commander to the JTF commander and the Joint Force Air Component Commander. It incorporates the features of previously separate systems: Joint Operational Tactical System (JOTS), Tactical Flag Command Center (TFCC), Afloat Correlation System (ACS), Electronic Warfare Coordination Module (EWCM), Naval Intelligence Processing System (NIPS), the Operational Support System (OSS) and most recently the Air Forces Contingency TACS Automated Planning System (CTAPS). The functional components of the NTCS-A and their capabilities are shown in figure 5.

[37] All information about NTCS-A is from : CNO C2I Division (N62), "Navy Tactical Command System- Afloat (NTCS-A) Joint Maritime Command Information System (JMCIS)," Briefing, Washington, D.C.: 15 December 1993.

## Figure 5. NTCS-A Functions and Capabilities

| Capability | Description |
|---|---|
| NTCS-A Intelligence Processing Services (NIPS) | Formerly standalone Naval Intelligence Processing Services (NIPS). Intelligence processing |
| CHART | Enhanced digital mapping capability |
| Sensitive Compartmented Information (SCI) subsystem | NIPS and Chart at SCI security level with one way tactical input |
| NTCS-A Integrated Tactical Environment Subsystem (NITES) | Oceanographic, weather, and environmental functions |
| All Source Remote Sensor Correlator | Naval and land ELINT correlation and display of emitters |
| Track to Track Correlator (TTC) | All source fusion for additional afloat correlation |
| Position Locating Reporting System (XPLRS) | Tactical display and identification of Marine groundforces |
| NTCS-A Imagery Exploitation Workstation (NIEWS) | Intelligence image processing |
| Integrated ATO processing | Using Air Force CTAPS |
| Tactical Decision Aids (TDA) | Search and Rescue planning, surface surveillance intercept planning, and Antiair warfare planning |
| Electronic Combat TDA | Electronic warfare planning |
| Strike Plot | High fidelity over land graphics and display of NIPS database |

Source: CNO C2I Division (N62), "Navy Tactical Command System- Afloat (NTCS-A) Joint Maritime Command Information System (JMCIS)," Briefing, Washington, D.C.: 15 December 1993.

## D. Marine Corps

The Marine Tactical Command and Control System (MTACCS) was in development since 1990. It has been set aside in favor of following a Navy approach. The Marine Corps will now build their functional C2 modules on the Navy's core software referred to above as Unified Build and will call it Marine Air Ground Task Force (MAGTF) C4I. They will either use hardware from Navy contracts or the Marine Common Hardware Software platforms. The Marine Corps is involved with the Navy in the preparation of the next hardware contract proposal called TAC-4. On top of the Unified Build software core they will utilize existing software programs from Navy and Army systems. The Army candidates are the Advanced Field Artillery Tactical Data System (AFATDS), and the Combat Service Support Control System (CSSCS). All the functional programs available with NTCS-A including CTAPS would also be available.[38]

[38] Telephone Conversation with Mike Drennan, Major, USMC, MARCORSYSCOM/C4I, Quantico, VA, 11 February 1994.

## 5. The Vision of C4I for the Warrior

"C4I for the Warrior" is the visionary approach put forth from the highest level of the command and control community, the C4 Systems Directorate of the Joint Staff, to develop an architectural "Objective" for the design of future C4 systems. The goal is to increase joint interoperability and insure the "Objective" is "derived from the Joint Warrior's requirements."[39] The C4I for the Warrior concept was first briefed to the Secretary of Defense, the Chairman of the Joint Chiefs of Staff, and the Joint Chiefs of Staff in February 1992. Driving the concept were a changing National Military Strategy (as discussed previously in this paper), the lessons learned from the Gulf War and prior joint operations, the rapid changes in computer technology, and the declining military budget. In a one page article in "Byte" magazine, General Collin Powell described the important role that computers played in Gulf War as a force multiplier and the challenges still ahead. Specifically he makes it clear to the computer industry that "interoperability among systems is crucial" for the information warrior.[40] The plan to insure interoperability as explained by Vice Admiral Macke, at that time the Director of C4 Systems, the Joint Staff, "is to develop an architecture , circulate it, and enforce it."[41]

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[39] The Joint Staff C4 Systems Directorate, *"Committed, Focused, and Needed" C4I For the Warrior* (Washington: 12 June 1993), p. 1.

[40] Powell, Collin L, "Information-Age Warriors." *Byte*, July 1992, p. 370.

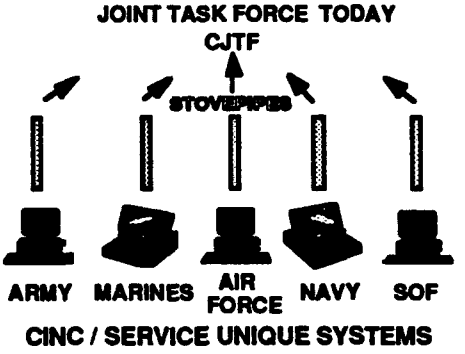
[41] "Information Exchange Poses Enhanced Warrior Prowess," *SIGNAL*, June 1992, p. 91.

The vision is sound and has been well received. It has been incorporated into the *Army Enterprise Strategy, THE VISION*,[42] The Air Force's *AF/SC Horizon*[43] and the Navy's Joint Maritime Command Information System (JMCIS). The vision is committed to the Warrior's need for "a fused real time, true representation of the Warrior's battlespace--an ability to order, respond and coordinate horizontally and vertically to the degree necessary to prosecute his or her mission in that battlespace."[44]

## A. Evolution from Service Stovepipes

The C4I for the Warrior concept also presents a road map to achieve the vision. The starting point is the present state of CINC and Service unique systems that comprise "stovepipes" to the joint forces commander. Figure 6 shows these stovepipes.

Figure 6. Present C4 Stovepipes




Source: The Joint Staff C4 Systems Directorate, *C4I for the Warrior*, p. 4.

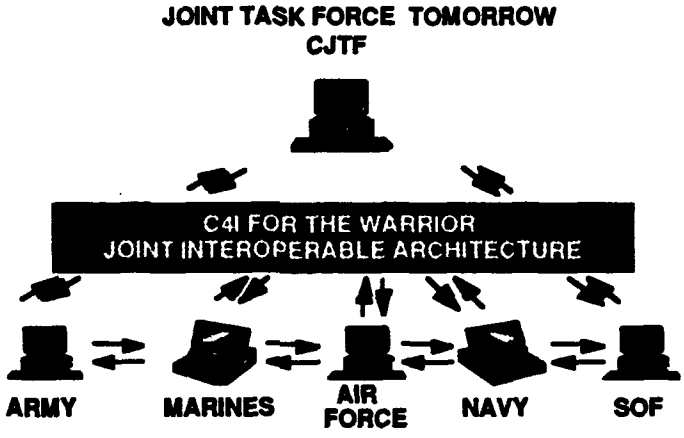
[42] Office of the Secretary of the Army, Director of Information Systems for Command, Control, Communications, and Computers, *The Army Enterprise Strategy, THE VISION*, (Washington: 20 July 1993), presents the single, unified vision for the Army C4I community.

[43] Office of the Air Force Deputy Chief of Staff, C4, *AF/SC Horizon*, (Washington), provides a fundamental reference for optimizing C4I capabilities into the 21st century.

[44] The Joint Staff C4 Systems Directorate, *C4I for the Warrior*, p. 4.

The desired target is a fully integrated C4 system that will provide the joint force commander and the staff seamless, one point access to all the component C4 systems. "The vision will be fully achieved when the entire Joint Task Force--all of the components--are functionally integrated, thereby truly interoperable."[45] This is shown by the two way communications among all the component C4 systems and between the component and JTF C4 systems as seen in figure 7.

Figure 7. Fully Interoperable C4I for the Warrior Architecture




Source: The Joint Staff C4 Systems Directorate, *C4I for the Warrior,* p. 5.

The guidelines presented for the transition stress the importance of true multi-service teamwork, the needs of the Warrior, continuing progress while providing service, taking advantage of the latest advances in technology, and quickly finding solutions to interoperability problems and get them into the hands of the Warrior.[46]

[45] Ibid., p. 5.
[46] Ibid., p. 4.

## B. The Global Infosphere

The Infosphere is a global network of military and commercial communications assets that will provide the connectivity to the warrior anywhere in the world. This concept parallels the Corporate Information Management initiative by providing seamless end to end access to Warriors at any level of the C4 system. The Infosphere will provide the computer communications and procedures needed to interconnect all C4I elements, networks, and authoritative sources of information. The Infosphere will be more than a global backbone network. It will be a reliable and secure source of information from various sources which appear to be a sole unified source. Additionally, it requires the ability to effectively manage the scarce C4I resources by planning, controlling, and monitoring the global backbone.

## C. The Warrior's Battlespace

The Warrior's Battlespace is defined as "any area over which the Warrior exercises control or has a military interest."[47] The idea is to provide the commander with all the information needed to determine what is happening in his battlespace. But even more important than having the information is the need to present the information in a format that makes it easier to understand. The battlespace picture must display all units of the ground, air, maritime, space, and special operations forces. Ideally it should display the location and status of all units, friendly and enemy, in near real time.

In order to do this the data must be available. This data is called the

[47] Ibid., p. 9.

battlespace information. It can be obtained by several means. First, the Warrior can pull the information on demand from the infosphere, the global C4I network, and view it in the desired form. Second, the data can be one of the essential elements of information that have been preplanned to be part of the initial static database. These are called "preplanned essential elements of information." Third, the data can be pushed to the Warrior over the infosphere. This will allow essential elements of information in the database to be updated according to rules that insure the information is useful. Additionally, there is the process of data fusion. This is the "process of receiving and integrating all-source, multimedia, and multiformat information to produce and make available to the Warrior an accurate, complete, and timely summary of essential information required for successful prosecution of operational objectives."[48] Data fusion allows the reliability of data to be increased as it is verified from multiple sources.[49]

To have these capabilities in the final phase of C4I for the Warrior it is necessary for developers to remain in contact with the users, the warfighter, so that future C4 systems will meet their needs. In order to meet these expectations, it will be necessary to push the leading edge of technology rather than be driven by technology. Progress is needed in several technological areas. Artificial Intelligence will be used for more effective data fusion, to develop dynamic rule bases for determining when and what essential elements of information to push to the Warrior, and to provide near real time decision aids. Data compression and transmission technology will provide more efficient means to transmit data so that the infosphere can keep up with the information

[48] Ibid., p. 13.

[49] Ibid., pp. 9-13.

transfer needs of the Warrior. This technology can be applied to any form of digital data but is especially needed for imagery and video transmission. Improvements in multilevel security will allow the C4I for the Warrior infrastructure to serve all security levels efficiently without parallel systems or networks.

The Warrior's interface to the system is very important. It should be "Warrior friendly" and have the same look and feel regardless at what level the C4 system is being used. It must be modular, transportable, scalable, multimedia capable, and secure.

## D. Phases

The three phases on the roadmap for achieving the C4I for the Warrior objective are the Quick Fix Phase, the Mid-Term Phase, and the Objective Phase. The Quick Fix Phase is over and has been declared a victory. During this phase systems with interoperability problems were identified by the Services and targeted to be either fixed or phased out. The Navy developed the Joint Universal Data Interpreter (JUDI) to translate message formats between four major existing C4 systems. The systems are The Navy's Joint Operational Tactical System, the Army's Standard Theater Army Command and Control System, the Air Force's Air Situation Display System, and the Marine Corps' former Marine Tactical Command and Control System. The result is that each of the Service's systems can receive data from each of the others allowing the creation of a fused tactical picture showing information from C4 systems all four services.[30] Other accomplishments during this phase are the acceptance and inclusion into the

[30] Ibid., p. 24.

Service doctrine the foundation of joint interoperability policy and coordination of efforts in C4I requirements and architecture.

The Mid-Term phased has already started. It will interconnect all the C4I networks to form a joint network of networks, an internet based on the Defense Information Systems Network (DISN). More dramatically it will produce "a global C4I system capable of generating and delivering increasingly fused information needed for tactical command decisions."[51] This is the new Global Command and Control System (GCCS) which will be discussed in the next section.

The Objective Phase will be reached by the end of the 90's. It will be built on the experience gained over the previous phases. It will use advanced technologies and continually optimize C4I support for the commander and his staff. It will provide a multifunctional workstation tailored to the user's needs, a Battlespace picture displaying fused information, and a global Infosphere. It will be technically and doctrinally sound. It will have a strong foundation built upon tested Strategy, Policy, and Doctrine. The Strategy is stated in the National Military Strategy Document (NMSD).

> Consistent with the "C4I for the Warrior" plan, all Service- and Agency-programed systems must be compatible and interoperable to support joint and combined operations across the entire spectrum of conflict.[52]

The Policy documents are clear. As discussed in the background section on policy above, the policy has been in place to ensure new or modified C4 systems are interoperable, standards based, and tested for joint use. The C4I joint

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[51] Ibid., p. 16.

[52] National Military Strategy Document (NMSD) FY 1994-1999, Annex C, quoted in The Joint Staff C4 Systems Directorate,*C4I for the Warrior,* p. 18.

doctrine is evolving, but more importantly it is being incorporated in the Services C4I doctrine.

# 6. The Global Command and Control System

The Global Command and Control System (GCCS) is the implementation of the C4I for the Warrior concept. It was initiated in December 1992 and is currently viewed as a "fast moving train" because it has received the direct interest of the Joint Staff Director for Command, Control, Communications, and Computer Systems (J6) and the Joint Staff Director of Operations (J3). The development of GCCS will use an evolutionary approach that will build a new way of doing business on the C4I for the Warrior foundation. This new business process will affect the development, acquisition, testing and fielding of GCCS. The grand design acquisition strategy of the past which typically took years and tied the government to a fixed specification and contract will be avoided. The GCCS implementation will not become a hardware acquisition project. The intent is to eliminate duplication of effort among the Services and CINCs in order to move at a faster pace, using incremental development, with rapid integration of new functionality. It will combine these efforts in a reengineering project to provide a common C4 system to support the needs of the warfighter from the National Command Authority to the JTF.

GCCS has been successfully installed and a proof of concept has begun at Atlantic Command headquarters. This is the first step to a complete implementation of GCCS at all the unified commands. The success of GCCS implementation is directly related to the termination of the Worldwide Military Command and Control System (WWMCCS). The WWMCCS modernization project was terminated by the Office of the Secretary of Defense.[53] As a result,

[53] Defense Information Systems Agency, GCCS Project Office, *Draft GCCS Implementation Plan* (Sterling Va: 15 February 1994), p. 2.

GCCS was created to implement the concepts of C4I for the Warrior as well as to provide a path for a coordinated effort to modernize the C4 systems supporting the CINCs. One of the major changes that will be made in the process is a change of the security level for the new system. Whereas WWMCCS has always run at the TOP SECRET level, GCCS will operate at the SECRET high level.

## A. Functionality

The functionality of GCCS is of primary concern and will be evolutionary. The GCCS core functions have been defined by the CINCs. They are:

- Crisis and Deliberate Planning
- Force Employment
- Logistics
- Fire Support
- Personnel
- Force Deployment
- Force Status
- Air Operations
- Intelligence
- Position of Units
- Narrative Information [54]

Functionality will be added to GCCS in blocks. Block I will consist of systems that are adaptable due to their current state of development and their proven functionality. Feedback from users of the Atlantic Command GCCS proof of concept will also influence the functions in the first block. Currently in Block I are the systems used in the proof of concept. These are the Dynamic Analysis Replanning Tool (DART), the Joint Defense Intelligence Support System (JDISS), the GCCS Status of Resources and Training System (GSORTS), the Standard Theater Army Command and Control System using a localized database, and the Contingency Theater Air Control System Automated Planning System(CTAPS).

[54] The Joint Staff C4 Systems Directorate, "Global Command and Control System (GCCS)," Briefing, Washington: 8 December 1993, p. 13.

The GCCS Status of Resources and Training System is an application that was migrated from the WWMCCS Status of Resources and Training System (SORTS) in a short period of time. The special version of the Standard Theater Army Command and Control System came from the US European Command Command and Control System (UCCS).[55] The proof of concept is being run on the Navy's Unified Build C2 core software and also utilizes Navy hardware. The other candidates for the first block are from the Technology Insertion Program that was originally developed as a means for integrating new technology into the Worldwide Military Command and Control System. These systems are the Joint Flow and Analysis for Transportation (JFAST), the Logistics Sustainment Analysis and Feasibility Estimator (LOGSAFE), the Force Augmentation Planning and Execution Systems (FAPES) and the Dynamic Analysis Replanning Tool which has already been incorporated.[56]

## B. Proof of Concept Results

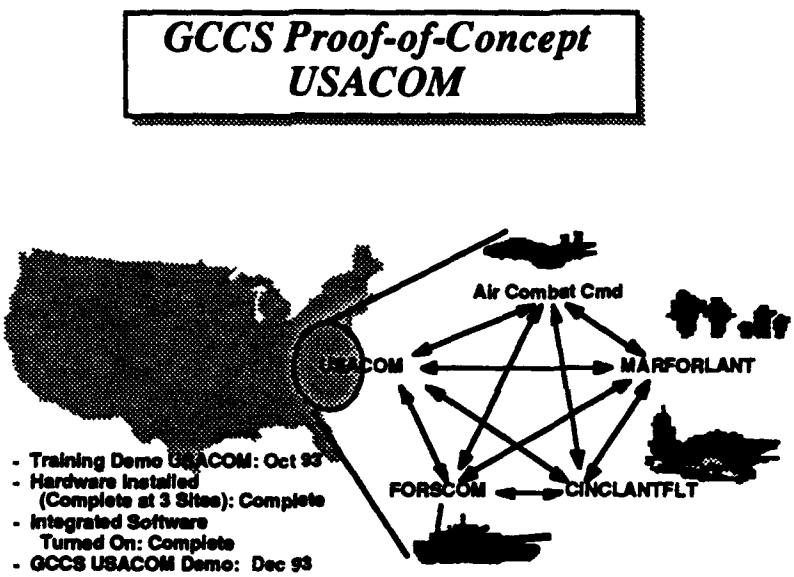
The feedback from the users demonstrates the success of the Atlantic Command GCCS proof of concept. It was quickly fielded to show the utility and feasibility of real time connectivity between a CINC headquarters and its components as shown in figure 8. Besides demonstrating these goals it was also used for real world operations in Haiti for which it received high praise. Specifically, GCCS was used to provide daily information briefings. The unit status display was much easier to read and the Graphical Situational Displays of

[55] US Atlantic Command, Director for Operations, "GCCS Proof of Concept Demonstration," Briefing, USACOM Headquarter, Norfolk, VA: 26 January 1994.

[56] Defense Information Systems Agency, GCCS Project Office, *Draft GCCS Migration* Strategy (Sterling Va: 1 February 1994), p. 3.

ship placement around Haiti were well received. The feedback also indicates the need for additional functions in the way of collaborative planning. The functionality of the Joint Operation Planning and Execution System (JOPES) is one of the most desired improvements.[57] Figure 9 is an example of how much easier an application can be to use on a "Warrior friendly" system.

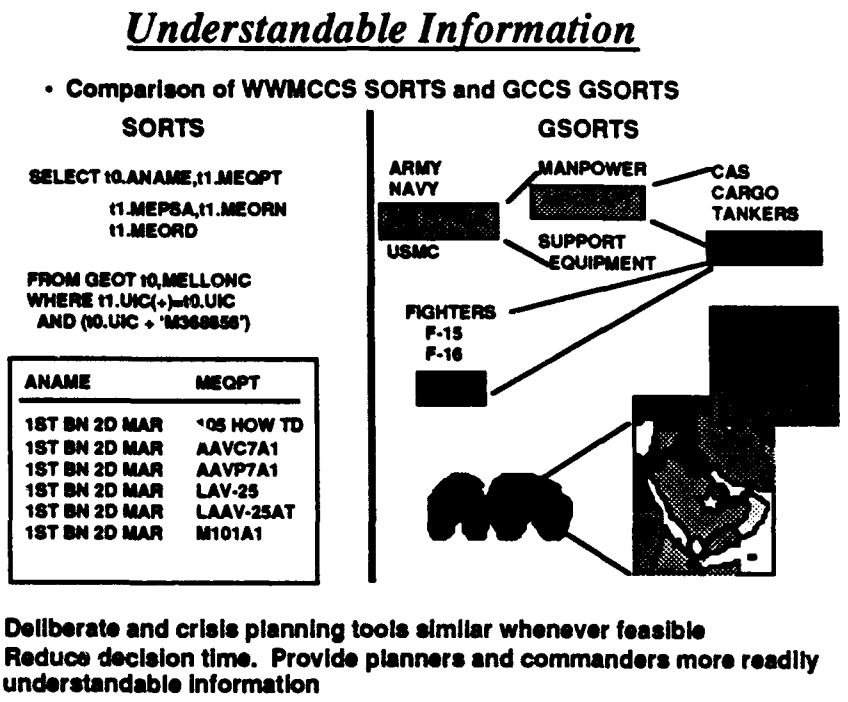
Figure 8. GCCS Proof of Concept Connectivity




Source: The Joint Staff C4 Systems Directorate, "Global Command and Control System (GCCS) Update," Briefing, Washington: February 1994, p. 13.

[57] The Joint Staff C4 Systems Directorate, "Global Command and Control System (GCCS) Update," Briefing, Washington: February, p. 14.

Figure 9. Comparison of WWMCCS SORTS and GCCS SORTS




Source: The Joint Staff C4 Systems Directorate, "Global Command and Control System (GCCS) Update," Briefing, Washington: February 1994, p. 12.

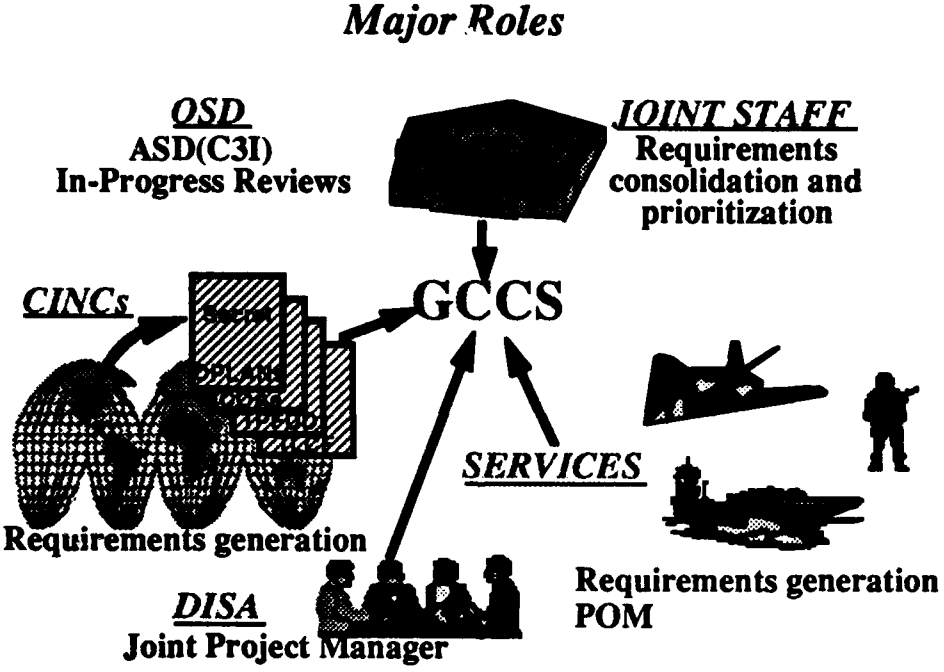
## C. Implementation

In block II more core utilities and core C4I functions will be evaluated and fielded. The Common Operating Environment will be established. This will be the software platform on which GCCS will be based. The Common Operating Environment will include the operating system, communications software, Graphic User Interface software, networking hardware and software suite, system administration utilities and applications, Application Programing Interface, standard and C2 specific programming libraries, underlying database,

database management system, and office automation applications. All of these will conform to the Department of Defense Technical Reference Model. This will enable any application developed at one GCCS site to be installed and executed at another GCCS site without any conversion. The Scheduling and Movement module of JOPES is also scheduled to be in Block II.

The process for adding C2 functionality will be based on functional working groups that will prioritize requirements, evaluate nominees submitted by the CINCs and Services, and recommend selections for final GCCS Advisory Board approval. This is the GCCS Best-of-Breed (GBOB) competition. Figure 10 shows the participants and their roles in defining GCCS functionality.

Figure 10. GCCS Players




Source: The Joint Staff C4 Systems Directorate, "Global Command and Control System (GCCS) Update," Briefing, Washington: February 1994, p. 9.

There are implementation concerns and possible pitfalls. One of the major issues is the migration of data to GCCS distributed databases. Part of the problem is that data currently exists on numerous systems with many sources and means of input. Data that exists in the WWMCCS environment is classified at a higher classification than GCCS will accommodate. Additionally, new databases must be developed and data element standardization is necessary for the complete database to be implemented. The process of data element standardization has been on going for years. In order to meet the target date for WWMCCS termination of September 1995, only 80% of the database might be migrated.[58] WWMCCS must be downgraded to the SECRET level before GCCS can access any of this data. Some of the functions that can not be downgraded and their data will use an alternate system, the Top Secret Support System (TS3). This system must be in place before WWMCCS can be downgraded. These are some of the scheduling problems and show how interdependent these issues are.

The question of what will happen to existing systems must also be addressed. The older C4 systems developed by the Services and CINCs are referred to as legacy systems. Many of these systems were built on WWMCCS. To ensure that the capabilities of these legacy systems are available they will transition from their former environments to the open systems environment of GCCS. This transition is schedule during Block II.[59] Of primary concern is that the GCCS be in place and tested before WWMCCS is turned off. Our nation can not afford to take the risk of its Armed Forces not having any capability for worldwide C2.

[58] Defense Information Systems Agency, GCCS Project Office, *Draft GCCS Implementation Plan* (Sterling Va: 15 February 1994), p. 7.

[59] Defense Information Systems Agency, GCCS Project Office, *Draft GCCS Migration Strategy* (Sterling Va: 22 February 1994), p. 2.

## D. Concept Of Operations

The Joint Staff Directorate for Command, Control, Communications and Computer Systems has been given the task by the Chairman of the Joint Chiefs of Staff, General Shalikashvili. "I will support only one [Joint] Command and Control System."[60] This is reflected in the GCCS Concept of Operations.

> GCCS will be a highly mobile, deployable C2 system that will support forces for joint and combined operations throughout the spectrum of conflict anytime and anywhere in the world with compatible, interoperable, and integrated C4I systems. GCCS will incorporate the policies, procedures, reporting structures, trained personnel, automated information processing systems, and connectivity to provide information necessary to plan, deploy, sustain, and employ forces. It will support the range of operations along the military continuum as envisioned by national military strategy. It will also allow response to natural emergencies and/or man-made disasters when military support is appropriate.
>
> The system will meet the C2 requirements of National Command Authorities through the Joint Task Force commander encompassing four main communities. These include: (1) National (NCA, NSC, CJCS, and Service Headquarters), (2) Theater (supported CINCs and their Component Commanders), (3) Joint Task Force (JTF Commanders and their Component Commanders), and (4) Supporting Groups (Supporting CINCs and their Component Commanders, Service Major Commands, Defense Agencies, United Nations/Host Nations/Allied Commands, and other US government agencies such as DEA, FEMA, FBI, and DOS). The system will provide the analytical tools and information processing technologies required for CINCs to develop and execute those plans and contingencies that support our national military strategy.[61]

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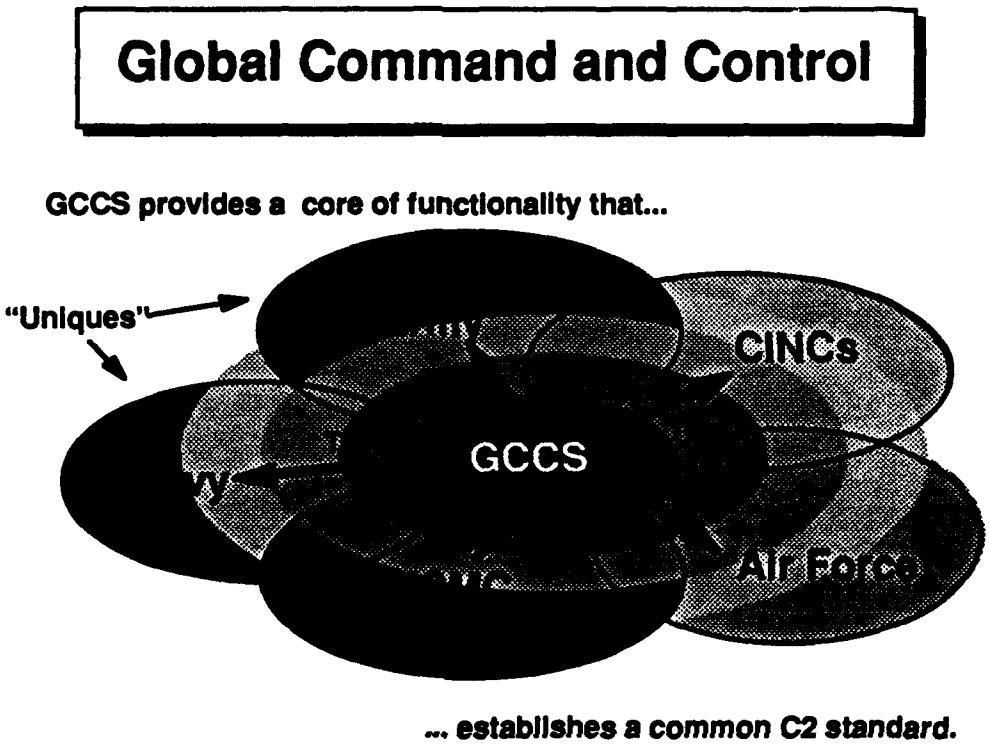
[60] General Shalikashvili, Chairman of the Joint Chiefs of Staff, made this statement on 12 January 1994 and is quoted in The Joint Staff C4 Systems Directorate, "Global Command and Control System (GCCS) Update," Briefing, Washington: February 1994, p. 16.

[61] The Joint Staff C4 Systems Directorate, Global Command and Control System (GCCS) Concept of Operations DRAFT, (Washington: 27 January 1994), pp. 1-2; NCA is the National Command Authority, NSC is the National Security Council, CJCS is the Chairman of the Joint Chiefs of Staff, DEA is the Drug Enforcement Agency, FEMA is the Federal Emergency Management Agency, and DOS is the Department of State.

Of particular interest is the requirement to meet the C2 needs of Allied Commands. This is becoming possible as great efforts have been made with Allied Services to share the work done on data standardization and the result is the C2 Core Data Model. This model consists of the core data required across all C2 functional areas and creates a common method of describing tactical C2 information needs.[62] Another example that shows this type of progress is the number of Allied countries whose navies are utilizing the U.S. Navy NTCS-A C4 system. Results from interoperability test at NATO also indicate improvements.

[62] Office of the Director of Information Systems for Command, Control, Communications, and Computers, *C2 Core Data Model - Executive Summary,* (Washington: 27 January 1994), pp. 1-2.

Figure 11. GCCS Functionality Grows Over Time.




Source: The Joint Staff C4 Systems Directorate, "Global Command and Control System (GCCS) Update," Briefing, Washington: February 1994, p. 9.

Figure 11 illustrates the integration of functions that is sought with GCCS. Notice how the Service's C4 systems remain unique which represent the fact that their requirements for C4 systems will always be tailored to meet the specific need of the particular Service. There will always be differences in the functional requirements of each Service since the organizational and procedural aspects of command and control are different at the lower levels of command. The beauty of the GCCS is how much overlap there is between the services and how much common functionality can be built into the GCCS core.

# 7. Conclusion

The Global Command and Control System implements the concepts of C4I for the Warrior. As a result, GCCS will provide the Warrior a global and highly interoperable C4 system. It is flexible and will satisfy the C2 requirements of any JTF regardless of size or organizational structure. The Global Command and Control System is real. It will not be an easy task over the next few years to fully implement its grand design. It will undoubtedly be the largest and most sophisticated information management system in the world. Given its mission, it will be the most important.

A few years ago few would have believed a system like the Global Command and Control System would have been possible. In fact, the thought of one common and standard information management system that could be configured as needed to meet the information processing needs just within the Army Staff seemed improbable. Where we are today is the result of a few well advised visionaries at the highest levels. They have applied the proven concepts of information technology utilization that have produced results in the civilian community. The use of standards based, open architecture computing will likewise prove its usefulness to the Department of Defense Command and Control community.

The Global Command and Control System will be the C4 system that will make the technical means transparent to the other categorizations of command and control means, the organization and the procedures, as define by Van Creveld.[43] The commander will be able to concentrate on organizing the JTF in a

[43] Van Creveld, Martin, Command in War, (Cambridge: Harvard University Press, 1985), pp. 9-10. This categorization of command means was discussed in the background section of this paper.

manner to best accomplish the mission rather than organizing it to best meet C4 system constraints. A goal of any good computer systems engineer is to make the information technology a tool that is a transparent part of the process rather than an obstacle in the process. This has been done in the Global Command and Control System design.

The common operating environment, the warrior friendly interface, and the core functionality will enable Joint Staff Officers to retain and reuse the experience gained with the Global Command and Control System regardless of what JTF, Service Component, or CINC staff they are called on to serve. Furthermore, it will assist the modern day warrior overcome a problem described over one hundred years ago by Clausewitz. Clausewitz stated, "A great part of the information obtained in war is contradictory, a still greater part is false and by far the greatest part is of doubtful character." With the Global Command and Control System the warrior will have much greater confidence in the information they use to make their crucial decisions. The Global Command and Control System should become **the standard** command and control system for all Joint Task Forces.

# 8. Recommendations

Some important strides have been made. Many more are yet to come. In order to reach the Objective Phase of C4I for the Warrior, the command and control community must keep an open mind; open to new ideas as well as new technology. The importance of the Global Command and Control System can not be over emphasized and the project must stay on track. When problems are encountered, teamwork must be used to solve them without getting bogged down. The Global Command and Control System is a fast moving train, but the project managers have to be willing to make scheduling changes and changes in procedures if they make sense. An example would be the delay of turning off a legacy system, such as WWMCCS, because GCCS just has not been able to incorporate the needed functionality on schedule.

Since the Global Command and Control System will be dependent on its distributed databases, the data element standardization efforts must receive emphasis from the highest levels. The work the Army and allied nations have accomplished with the development of the C2 Core Data Model is noteworthy and should be utilized to the fullest extent possible to solve this difficult problem.

The enormous size of this project calls for some special organizations. It is critical that the Defense Information Systems Agency who will be the Migration Director for the GCCS program and the Joint Staff Directorate for Command, Control, Communications, and Computer Systems (J6) who will be the GCCS Manager be properly staffed. Just as a JTF must be staffed to accomplish its mission, these organizations need new GCCS divisions created and filled with

qualified personnel to meet the demands ahead. Forming new organizations within the Defense Information Systems Agency might also help allay fears within the user community about its responsiveness and expertise.[44] Additionally, some stability is needed within this organization. The number of reorganizations and name changes within the Defense Information Systems Agency over the past few years has employees wondering about their organization's name and customers wondering who to turn to for support.

Training for the Global Command and Control System is another important area. GCCS systems must be made available for training at the Armed Forces Staff College so that personnel going to joint assignments will be familiar with the program. Additionally, support personnel for the legacy systems that will be terminated should receive GCCS operators training as soon as possible. They must be familiar with GCCS so that their expertise can continue to be an asset as they are called on to support new GCCS installations.

To ensure that a newly formed JTF has as robust a GCCS system as is needed to perform its mission, there needs to be a capability to augment automation resources, both with equipment and personnel. This augmentation would provide the GCCS hardware with C2 applications already installed if it is requested by the CINC. This augmentation capability should be similar to the communications augmentation capabilities provided by the Joint Communications Support Element (JCSE). The Joint Communications Support Element's mission could be expanded to include this automation support,

[44] A recent example was DISA's decision last December to prevent military users of the Defense Data Network (DDN) from having access to the worldwide Internet for security reasons. "Critics are calling the plan technically inept". Not only were there better ways to increase security the move would have been expensive. The decision was reversed in January. Messmer, Ellen, "DOD plan may cut ties to Internet," *Network World,* 10 January 1994, p.1.

another organization could be given this task, or the CINCs could maintain the needed JTF automation augmentation. Additionally, the exact amount of augmentation that would likely be needed should be determined.

Finally, as already recognized, input from Global Command and Control System users is essential. The Migration Director and the GCCS Manager must always remember who their customers are and continually solicit their input. They should also encourage other warfighters who may not be directly involved with GCCS to provide input. Students at the Armed Forces Staff College who are just learning the system and other new users would be good candidates. Maximum user participation is also needed during the iterative prototyping process which will be used to test new functionality selected by the best of breed competition before it becomes a final GCCS product.

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